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RENT SEEKING AND RENT SETTING WITH ASYMMETRIC EFFECTIVENESS OF LOBBYING

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Rent Seeking and Rent Setting with Asymmetric Effectiveness of Lobbying†

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IRIS Summary **Working Paper No. 75**

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Activities such as lobbying are motivated by the desire to capture economic rents. Given the potential for such rent seeking, self-interested regulators may find it profitable to create such rents, for which firms will then compete. A countervailing force on such behavior is the pressure of consumers who may lose from the creation of such rents. This pressure exists because consumers may affect the probability of reappointment or reelection of regulators. This paper uses a framework developed by Appelbaum and Katz how asymmetries in effectiveness of rent seeking firms can affect the outcome. Previous work by Kohli had compared Nash and Stackelberg outcomes for a rent seeking game with such asymmetries in effectiveness, but where the rent was exogenously given. Here we examine how the costs of rent seeking vary for the Nash and Stackelberg cases as the degree of asymmetry varies, allowing for the endogeneity of the total rent. Furthermore, we show that in some circumstances, the rent seeking costs will be independent of the nature of the rent seeking game, because of the way that regulators adjust the amount of the rent.

The implications of this kind of analysis are that policy interventions to alleviate the consequences of rent seeking can occur at several levels, and that such interventions should be part of an overall approach. For example, changing the rules of the rent seeking game may not be enough when self-interested regulators can vary the total amount of the rent to negate such changes. The additional policy that would be required in such a case would be to also modify the incentives faced by such regulators.

RENT-SEEKING COSTS, GOVERNMENT OBJECTIVES AND INSTITUTIONAL STRUCTURES*

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ABSTRACT

This paper uses a model of rent-seeking to explore how different government welfare objectives may affect the choice of institutional structures within which that rent-seeking subsequently takes place. The resulting costs of rent-seeking are also compared. Institutional differences are modelled as asymmetries in the effectiveness of lobbying groups, or in their ability to precommit. In particular, we find that overriding concern for equity may lead to institutional structures that make rent-seeking costs relatively high.

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1. Introduction

An extreme view of government is that it is composed of entirely self-interested individuals, and this makes it susceptible to lobbying, corruption, rent-seeking and other behavior in that domain. No doubt, this view is supported by various current and historical examples. At the other pole is the characterization of government as an agent of its constituents, seeking to maximize an agreed upon measure of social welfare that appropriately aggregates constituents' preferences. This view may seem somewhat further from our understanding of human nature. And yet the record of progress in governmental forms suggests that one cannot ignore this optimistic characterization.

Perhaps a compromise approach is the best.[1] In this paper, we take such a position. We assume that rent-seeking occurs and that the government is susceptible to its influence. But we also assume that the government will try to mitigate its effects.[2] Two factors explain any seeming contradiction between these assumptions. First, there is a difference in timing: institutions that provide the framework within which subsequent routine economic actions occur are put in place infrequently,

[1] This may strike the student of the philosophy or history of government as a simplistic introduction, but we hope it will suffice for our purpose, which is to explore some particular questions in the content of a simple economic model. Broader issues of government are discussed in the work of Buchanan and Tullock (1962), Downs (1957), and many other economists as well as in the writing of political philosophers.

[2] Another paper that allows for both these factors, in a different context, is Feenstra and Bhagwati (1982).

and subject to inertia. Second, the individuals who frame institutions may be different from those who daily implement economic policies. The model we present will be a stylized and simplified version of reality, but we hope it provides a useful step towards developing an analysis of how rent-seeking may be managed and its costs mitigated.

Our model is in the tradition of the rent-seeking literature, which has recently grown very large, but whose seminal contributions include Olson (1965), Tullock (1967), Krueger (1974) and Bhagwati (1982).[3] The particular model we employ was suggested by Tullock (1980) and further developed in numerous ways, many of which are surveyed in Hillman (1989). Our immediate point of departure is work by Kohli (1992, 1994). She focuses on evaluating the costs of rent-seeking and how they are affected by two kinds of asymmetry between rent-seeking groups. The first such asymmetry is in the effectiveness of rent-seeking, measured by the impact of outlays for influence activities on the probability of capturing the rent.[4] The second asymmetry is in the timing of the rent-seeking outlays, or the kind of precommitment possible.[5] She examines precisely how rent-seeking costs depend on the presence or degree of these two asymmetries, and discusses how this relates to the design of institutions or policies to mitigate the costs of rent-seeking.

This paper extends the work of Kohli by looking in further detail at the possible objectives of those who might design the institutions under which rent-seeking subsequently occurs. As we have noted, the objectives of those such as constitution-makers or institution builders may differ from the goals of individuals who are responsible for the implementation of policies. In Kohli (1992, 1994), the latter are assumed to be susceptible to lobbying or other influence on rent-seeking activities, while the former seek to design rules that minimize the costs of such rent-seeking, knowing that it will occur. This minimizing of costs is equivalent, in the model used, to

[3] We would like to emphasize that this is not meant to be an exhaustive list of important contributions in this area.

[4] Alternatively, this can be replaced by the share of the rent captured by that group. In our formulation, as will be clear when we present the model, the two are formally equivalent.

[5] Both these asymmetries have been examined separately, e.g., Rogerson (1982) for the first, and Dixit (1987) for the second. This paper and Kohli (1992, 1994) are distinguished by their combination and the precise questions that are analyzed.

maximizing the sum of the welfare of the rent-seeking groups or individuals, i.e., the welfare function is purely utilitarian. In this paper, therefore, we modify this assumption in two ways, and examine how this affects Kohli's (1994) results. The first modification is to consider the case where the rule makers have a more general Bergsonian social welfare function,[6] which is a weighted sum of constituent welfare functions. This allows one to address questions of bias, or attempts to redress balance, in the objectives of the rule makers. The second possibility we consider is concern for equity, and we examine this in its extreme manifestation, namely, the Rawlsian social welfare function. The impact this has on some of the results of Kohli (1994) is striking.

We must emphasize here that we maintain one major simplifying assumption from Kohli (1992, 1994), which also characterizes much of the formal analysis of rent-seeking. This is the assumption that the amount of the rent being contested is a given constant. This simplifies analysis by allowing us to focus on the objectives of benevolent rule makers rather than the behavior of those in government who benefit from rent-seeking. In some other work, Kohli and Singh (1993), we have begun an effort to examine our questions about the relationship between rent-seeking costs and institutions in a framework where the rent is endogenous. In that framework,[7] consumer interests are also modeled, and must also be considered in welfare analysis. In the current analysis the fixed rent means that consumer benefits or losses are unaffected by the differences in institutions or policies that we consider. Thus we are justified in restricting attention to the welfare of the rent seekers.[8]

The plan of the rest of the paper is as follows. In section 2, we lay out the basic model, and discuss some illustrative examples to make concrete what aspects of reality the model captures and

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6 A good formal textbook treatment of these and other social welfare functions in general is Kreps (1990). We, of course, are applying such concepts in a limited way.
7 The basic model we use there is taken from Appelbaum and Katz (1987).
8 Yet another group is the beneficiaries of rent-seeking: say the bureaucrats who receive bribes or other payoffs. We may assume that high-minded institution builders will not want to weight their welfare.

what it leaves out. In section 3, we describe the basic Nash equilibrium in rent-seeking outlays, summarize some earlier results of Kohli, and provide some suggestive illustrations. In Section 4, we introduce asymmetry in timing of moves, and summarize additional earlier results. These two sections set the stage for our current analysis, in sections 5 and 6, of the ranking of different structures of rent-seeking when the rule makers have, respectively, a Bergsonian and a Rawlsian social welfare function. Section 7 summarizes our new results and concludes the paper.

2. A Model of Rent-Seeking

The simplest model that illustrates the basic insights is used. There are two agents or groups engaged in contesting a fixed rent. Each group receives a share of the rent that depends on its effort, which it chooses, the other group's effort, and its relative effectiveness, which is given. This relative effectiveness can vary due to prior relationships, access to communication channels, size and so on. The two groups are assumed to behave noncooperatively. These assumptions, except for the possibility of differences in effectiveness of lobbying (Rogerson, 1982, being a notable exception in incorporating such a difference), are common in this literature. The basic formulation seems to be due to Tullock (1980), though subsequent refinements have been numerous.

The notation is as follows:

R : the rent to be divided or shared

v_i : the expenditure incurred by person, firm or group i

a : the relative effectiveness of group 1

The relative effectiveness parameter enters the determination of the shares of rent as follows:

person 1's share is $s_1 = \dfrac{av_1}{(av_1 + v_2)}$

person 2's share is $s_2 = \dfrac{v_2}{(av_1 + v_2)}$

These are not defined for $(v_1,v_2) = (0,0)$ in which case we set s = 1/2.

This formulation assumes a form of constant returns to lobbying expenditure, but this can be relaxed without affecting the main insights.

Group 1's objective is then to solve $\max_{v_1} \quad W_1 = s_1 R - v_1 = \dfrac{av_1 R}{(av_1 + v_2)} - v_1.$

The other group has a similar objective function, $W_2 = \dfrac{v_2 R}{av_1 + v_2} - v_2.$ [9]

We now briefly discuss this formulation of the model. As noted, we shall assume that the rent, R, is exogenously determined, and focus on the competition for the given rent. For example, the rent could be determined by an import quota, and the share of the rent by the share of import licenses allocated. In Figure 1, the shaded area is the rent created by the import quota, represented therefore by R in our model. It may be that the quota is determined by some external agency, and changes infrequently, whereas the actual allocation of licenses is performed regularly by middle level bureaucrats who cannot alter the quota.

[Figure 1 here]

Another example could be regulation of a monopolist. In figure 2, D is the market demand curve, P_c is the competitive price, and P_m is the profit-maximizing monopoly price. The shaded area is the rent, R, that is available, being the additional consumer surplus generated by a fall in price from P_m to P_c. If P_r is the price set by regulators, this corresponds to the sharing of the rent. Note that

[9] We may see from this form of objective function that a formally equivalent alternative interpretation is possible. Let the shares instead be probabilities of capturing an indivisible rent, and welfare be in expected terms, with risk neutrality assumed. Then the objective function is unchanged.

in this case, the model represents an approximation, since at any price above P_c there is a deadweight loss triangle, so that the total rent is less than R at such prices. In fact, the rent decreases systematically as P_r increases. If the idea of approximation is troubling, one can think of the rent being shared between the regulated firm and consumers by other pricing schemes., e.g., two-part tariffs, that result in no deadweight loss.[10]

[Figure 2 here]

In the second example, the two rent-seeking groups are the regulated monopolist and consumers. An alternative situation would be where P_r is given, but more than one regulated firm can share the market. Then these firms would be the rent-seekers. This would be quite similar to the first example. In such cases, there can, of course, be more than two rent-seeking groups. We restrict attention to the case of two to avoid needless complications in making our points.

Other examples of rent-seeking are also possible. These include the allocation of industrial licenses, the execution of public good projects such as irrigation canals, and general lobbying for tax-breaks, exemptions, etc. Some of these examples are discussed in more detail in Kohli (1994).

3. Nash Equilibrium

In this section, we describe the basic Nash equilibrium of the model, summarize some previous results of Kohli (1992, 1994) and provide some interpretations of those results.

To derive the Nash equilibrium, we differentiate each group's objective function, set the derivatives equal to zero - which implicitly defines the reaction functions - and solve two equations

[10] Some formal analysis of the case where the total rent depends systematically on how it is shared is in Kohli (1992).

in the two unknowns $v_1{}^*$ and $v_2{}^*$. We also check the second order conditions for each person.

The result of these operations is the Nash equilibrium:

$$v_1^* = v_2^* = \frac{aR}{(1+a)^2}$$

This symmetry of outcomes, despite the asymmetry of effectiveness, comes about because the marginal effects on shares of rent due to lobbying have similar forms for the two sides.

The total cost of the rent-seeking, assuming, as is usual in this literature, that the rent- seeking expenditures are pure waste rather than transfers,[11] is just the sum, or double the individual outlay. Using C for cost and a superscript N to denote the Nash equilibrium, we have:

$$C^N = \frac{2aR}{(1+a)^2}$$

Finally, some simple differentiations show that these costs are maximized, given R, at a = 1, i.e., when the two rent-seekers are equally effective. This result is discussed next.

One can think of many situations where one lobby, or a subset, if there are more than two, has greater effectiveness than the other. Industrialists competing for a protectionist policy or award of monopoly can differ in effectiveness because of differential degrees of association with the government - the industrialist whose brother-in-law is the Minister for Industries could have a distinct advantage over others. Labor unions and capitalists, or agriculturists and industrialists, can differ in effectiveness because of government ideology. Consumers and industrialists can differ in their effectiveness due to differential degrees of learning by doing effects. In many developing

[11] Since R is exogenous, this is without loss of generality if each group's wasted resources are the same proportion of their rent-seeking outlays.

countries consumer organizations are poorly developed relative to the lobbying network of industrialists. In the stylized model, these differences in effectiveness are captured in the parameter "a," and the further it is from one, the greater the asymmetry in lobbying effectiveness and the lower the costs of rent-seeking.

The result then seems to fit in with Bardhan's (1984, p. 61) analysis of the political economy of development in India, "When diverse elements of the loose and uneasy coalition of the dominant proprietary classes pull in different directions and when none of them is individually strong enough to dominate the process of resource allocation, one predictable outcome is the proliferation of subsidies and grants to placate all of them." While this may be saying more about the size of the rent, the associated costs have also been high, e.g., as described in Bhagwati and Desai (1970).

It is also interesting to compare India and South Korea in this context. As Bardhan (1984) has noted, because of the conflicts between the equally influential "rent-seeking proprietary classes," the Indian economy has become "an elaborate network of patronage and subsidies." In contrast, in Korea, government decision-making is "untrammelled by the checks and balances of a multi-polar political system." As Datta-Chaudhuri (1990, p. 36), notes, "Land reforms destroyed the political power of the landed aristocracy and helped the emergence of the commercial and middle classes as the dominant elite in the country."

These examples are, of course, merely illustrative, and there have been numerous differences between India and South Korea in addition to costs of rent-seeking. Within the limitations of the model, however, we do have the result that rent-seeking costs are always reduced by increasing the disparity of effectiveness of the rent-seeking groups. In sections 5 and 6 we shall explore how this result is altered when objectives are different from simply minimizing these costs.

4. The Timing of Rent-Seeking

Most of the previous literature on rent-seeking has focused on the case of non-cooperative simultaneous move games, resulting in Nash equilibria. However, in many cases, it makes more sense to analyze Stackelberg equilibria. Consider, for example, the case of lobbying for a protectionist policy. The industrialist lobbies for a protectionist policy and then consumers counter-lobby against the protection. Here, the industrialist first commits to its strategy, and should appropriately be modeled as the Stackelberg leader. The consumers respond to the industrialist's strategy, acting as the followers. Similarly, some cases of lobbying for monopoly regulation are more appropriately analyzed for Stackelberg equilibrium.

Therefore, consider the case where group 1 acts as the leader,[12] and use the superscript SL for it, and SF for the follower. The analysis in the remainder of this section is summarized from Kohli (1994). The leader takes account of group 2's reaction function in its objective function. Group 2's reaction function is

$$\begin{array}{ll} v_2 = \sqrt{av_1R} - av_1 & , \quad 0 < v_1 < R/a \\ \quad 0 & , \quad v_1 \geq R/a \end{array}$$

Hence, the leader's objective function becomes

$$W_1 = \frac{av_1R}{\sqrt{av_1R}} - v_1, \text{ for } v_1 < R/a.$$

It is easy to show that $v_1^{SL} = \dfrac{aR}{4}$ and $v_2^{SF} = \dfrac{aR(2-a)}{4}$, which is positive for $a \leq 2$.

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[12] This is without loss of generality, since "a" is relative effectiveness. Hence equilibrium with group 1 as follower is given by the reciprocal value of "a."

Thus,

$$C^s = \frac{aR(3-a)}{4}$$

and $s_1 = \frac{a}{2}, s_2 = 1 - \frac{a}{2}$.

For a > 2, $v_1^{SL} = \frac{R}{a}, v_2^{SF} = 0$

and $C^s = \frac{R}{a}$.

It is easy to show that the rent-seeking costs are highest in this case when a = 3/2, i.e., when the two players are not equally effective in lobbying, but rather when the leader is somewhat more effective. To understand this result, one can examine the equilibrium outlays as functions of "a." For the leader, v_1^{SL} is always increasing in "a." For the follower, v_2^{SF} is increasing in "a" for a < 1, and decreasing for a > 1. Hence, the rent-seeking costs, which are the sum of v_1^{SL} and v_2^{SF}, must be increasing at a=1. As "a" continues to increase, however, the reduction in the follower's outlay begins to counteract the increase in the leader's expenditure, and the rent-seeking costs start to decline in "a."

It is now instructive to compare the two rent-seeking equilibria. Using the above expressions we can show that, for a < 2,

$$C^N - C^S \begin{cases} > 0 & \text{as} \quad a < 1 \\ < 0 & \qquad\; a > 1 \end{cases}$$

For a ≥ 2,

$$C^N - C^S \begin{cases} < 0 \text{ for } 2 < a < 1+\sqrt{2} \\ > 0 \text{ for } a > 1+\sqrt{2} \end{cases}$$

Note that when the two lobbyists have equal influence, the rent-seeking costs are the same whether they move simultaneously or sequentially. In fact, for a=1, the Nash and Stackelberg equilibria are identical. In general, however, when the two players have asymmetric effectiveness of lobbying, the rent-seeking costs, the shares of the rent received and the net payoffs differ. The rent-seeking costs are higher in the Stackelberg case when "a" is between 1 and $1 + \sqrt{2}$. The upper bound's precise value is assumption dependent and not significant, but the general nature of the result is instructive. If the more effective group is able to precommit, and does not have an overwhelming advantage in rent-seeking effectiveness, the rent-seeking costs are *higher* than without the precommitment possibility.

The rent-seeking costs are not the only outcome of interest. It is also useful to compare the distribution of the rent that results from the lobbying process in the Nash and Stackelberg cases. For the Nash case, the shares are simply a/(1+a) and 1/(1+a). The shares therefore reflect the relative effectiveness of the two lobbyists. In the Stackelberg case, the shares are a/2 and 1-a/2 respectively, for leader and follower. In fact, agent 1's share is higher as a Stackelberg leader than in the Nash game if and only if a > 1.

From the lobbyists' viewpoint what matters is not just the share of rent, but the net welfare after lobbying costs are subtracted. The welfare expressions for each player in the two cases are easily derived. In the Nash case they are:

$$W_1^N = \frac{a^2 R}{(1+a)^2} \quad \text{and} \quad W_2^N = \frac{R}{(1+a)^2}$$

In the Stackelberg case they are:

$$W_1^{SL} = \begin{cases} \dfrac{aR}{4} & , \ a < 2 \\ \dfrac{(a-1)R}{a} & , \ a \geq 2 \end{cases} \quad \text{and} \quad W_2^{sr} = \begin{cases} \dfrac{(2-a)^2 R}{4} & , \ a < 2 \\ 0 & , \ a \geq 2 \end{cases}$$

Using these expressions, it is possible to prove that the Stackelberg leader is always better off than in the Nash situation, whatever the value of "a," while the Stackelberg follower is better off than in the Nash case if a < 1 (the leader is relatively less effective), and worse off if a > 1. Hence, for a < 1, *both* lobbyists are better off and the rent-seeking costs are lower in the Stackelberg game than in the Nash game. This striking result is proved in Kohli (1994), where it is termed the "underdog" theorem, since it is socially beneficial in the model context to allow the underdog to precommit.

To summarize this section, we note several points. First, if one of the rent-seeking or lobbying groups can precommit, while extreme disparities in effectiveness lead to lower rent-seeking costs, these costs are not highest when the groups are equally effective, but when the leader is somewhat more effective. Second, precommitment by one group leads to lower rent-seeking costs, as compared to the no-precommitment case, when there are extreme disparities in effectiveness, or when the underdog can precommit. In the latter case, both groups are better off than with no precommitment.

Once again, these results are suggestive for the design of the institutions or rules within which rent-seeking takes place. For example, in the case of regulation of monopoly, it may be beneficial to allow consumer groups to make rate proposals to which the firm responds, rather than the other way around, if the firm is more effective and consumers are the underdog group in terms of effectiveness of lobbying. In the next two sections, we examine the sensitivity of such policy prescriptions to differences in the objectives of the rule makers.

5. Bergsonian Welfare Function

The goal of minimizing the costs of rent-seeking, in the context of our model, is equivalent to maximizing the sum of the welfare of the two rent-seeking groups. This is because the amount of the rent being contested is taken as exogenous. As noted, this is reasonable where the rent is determined by a policy or rule that cannot be changed frequently. Even in this case, however, the objective of institution-makers who can determine the nature of precommitment possible, or who can have some impact on the relative effectiveness of rent-seekers, may be more general than the maximization of the sum of welfare. In this section, we examine how previous results are changed when the objective is a Bergsonian welfare function, i.e., a weighted sum of the welfare of the two rent-seeking groups.

Accordingly, let γ be a parameter which represents the relative weight given to the first rent-seeking group. This may be different from one because of biases towards or away from this group, or to allow for concerns about distribution. For example, if the relative effectiveness of group one in rent-seeking (the parameter "a") is low, this may be compensated for by a high value of the parameter γ. Accordingly, aggregate welfare in this case is given by

$$W^i = \gamma W_1^i + W_2^i ,$$

where i = N or S representing the Nash and the Stackelberg cases.

Our goal is to first examine how welfare depends on relative rent-seeking effectiveness with and without precommitment, and then to compare the two cases.

We begin with the case of Nash equilibrium. Here

$$W^N = \gamma W_1^N + W_2^N$$

$$= \frac{\gamma a^2 R}{(1+a)^2} + \frac{R}{(1+a)^2}$$

Differentiation and simplification show that

$$\frac{\partial W^N}{\partial a} = \frac{2R}{(1+a)^3}(\gamma a - 1)$$

Hence
$$\frac{\partial W^N}{\partial a} \begin{array}{ll} < 0 \quad , & a < 1/\gamma \\ = 0 \quad , & a = 1/\gamma \\ > 0 \quad , & a > 1/\gamma \end{array}$$

Thus W^N has a global minimum at $a=1/\gamma$, that is, where relative effectiveness negates, in a sense, the welfare weight. The implication is that if the welfare of the two groups is evaluated differently, then equal effectiveness is no longer the worst outcome. For example, if $\gamma > 1$, then the worst outcome occurs when the first group is relatively less effective. It remains the case, however, that the further one moves away from the critical value - now $1/\gamma$ rather than one - the higher is welfare.

Further insight may be gained by considering the rent-seeking costs alone. In this case, allowing for the welfare weighting, these costs are

$$C^N = \frac{(\gamma + 1)aR}{(1+a)^2}$$

It is clear that this expression is still highest at a=1. Thus the difference in overall evaluation is coming about because of the different evaluation in this case of the gross gains of rent-seeking to the two groups. Note that when γ=1, this is immaterial because $W^N = R - C^N$, so that W^N is lowest whenever C^N is highest.

A further possibility is that since effectiveness is potentially or partially determined by factors such as closeness to the regulators, there may be a relationship between γ and "a", which may be expressed by writing the welfare weight as a function γ(a). If there are similar factors influencing both effectiveness and the relative welfare weighting, we may have $\gamma'(a) > 0$. If, on the other hand, the rule-maker somehow tries to compensate in its welfare evaluation for differences in effectiveness, then $\gamma'(a) < 0$. In either case, the expression for $\dfrac{\partial W^N}{\partial a}$ becomes

$$\frac{R}{(1+a)^3}\left[2(\gamma a-1)+(1+a)a^2\gamma'(a)\right]$$

Hence the minimum[13] for W^N can be above or below 1/γ(a), depending on whether $\gamma'(a)$ is negative or positive. In fact, in some cases, there may be no minimum. For example, if the rule-maker sets $\gamma = 1/a$ to perfectly compensate for the difference in effectiveness, the welfare expression reduces to R/(1+a), which is always decreasing in "a." This contrasts greatly with the case where γ is independent of "a."

Turning to the Stackelberg case, the expression for welfare is

$$W^S = \begin{cases} \dfrac{R}{4}\left[\gamma a + (2-a)^2\right] & a < 2 \\ \gamma R(a-1)/a & a \geq 2 \end{cases}$$

[13] Now there can be more than one local minimum, but the following is true for each of them, and therefore for the global minimum.

Assuming once again that γ is constant,

$$\frac{\partial W^S}{\partial a} = \begin{cases} \frac{R}{4}[\gamma - 2(2-a)] & a < 2 \\ \gamma R / a^2 & a \geq 2 \end{cases}$$

Now we have

$$\frac{\partial W^S}{\partial a} \begin{cases} < 0 \quad , \quad a < 2 - \gamma / 2 \\ = 0 \quad , \quad a = 2 - \gamma / 2 \\ > 0 \quad , \quad a > 2 - \gamma / 2 \end{cases}$$

Hence W^S has a global minimum at 2- $\gamma/2$. Note that as γ approaches zero, this value for "a" approaches 2. As γ becomes large, however, we reach the admissible boundary for "a." Specifically, for $\gamma \geq 4$, the worst case is when a=0, or the first group is completely ineffective, and any increase in the first group's effectiveness will increase welfare.

Once again, as in the Nash case, we see that γ and the level of "a" at which welfare is lowest are inversely related. Earlier results, reported in the previous section, were for $\gamma = 1$, in which case the worst outcome is "a" = 3/2. If, instead, $\gamma = 2$ so that the welfare of the first group is weighted twice that of the second, the worst outcome is when "a" = 1, i.e., the two groups are equally effective in rent-seeking.

Next we compare the Nash and Stackelberg equilibria for the case of a general value for γ. We have, for a <2 ,

$$W^N - W^S = \frac{R(1+\gamma a^2)}{(1+a)^2} - \frac{R}{4}\left[\gamma a + (2-a)^2\right]$$

After some algebraic manipulations, this becomes

$$W^N - W^S = \frac{R}{4(1+a)^2}\left[a(1-a)(a^2 - a(1-\gamma) - (\gamma+4))\right]$$

Since $a^2 - a(1-\gamma) - (\gamma + 4) < 0$ for $0 \leq a < 1$, the above expression is negative for this range of relative effectiveness, i.e., the Stackelberg equilibrium is better. If $1 < a < 2$, this quadratic has a root between 1 and 2 if $\gamma > 2$. Denote this by $\alpha_1(\gamma)$. If $\gamma < 2$, then the quadratic is always negative. Since the welfare difference also contains the term $(1 - a)$, we have, if $\gamma < 2$,

$$W^N - W^S \quad \begin{array}{ll} <0 , & 0 \leq a < 1 \\ =0 , & a = 1 \\ >0 , & 1 < a < 2 \end{array}$$

If, on the other hand, $\gamma \geq 2$, we have

$$W^N - W^S \quad \begin{array}{ll} <0 , & 0 \leq a < 1 \\ =0 , & a = 1 \\ >0 , & 1 < a < \alpha_1(\gamma) \text{ [14]} \\ =0 , & a = \alpha_1(\gamma) \\ <0 , & a > \alpha_1(\gamma) \end{array}$$

Hence part of the comparison generalizes from the case of $\gamma = 1$ considered earlier: there is no change in the relative ranking of the two cases if $a \leq 1$. For $a \geq 2$, since the expression for W^S is different, we have

$$W^N - W^S = \frac{R(1+\gamma a^2)}{(1+a)^2} - \frac{\gamma R(a-1)}{a} \quad ,$$

[14] It can be shown that $\alpha_1(\gamma) > 1$, so this interval exists.

which after some algebra reduces to

$$W^N - W^S = \frac{R}{a(1+a)^2} - \left[a + \gamma(1+a-a^2)\right] \quad .$$

The expression in brackets can be equated to zero and solved to obtain a function $\alpha_2(\gamma)$. The difference in welfare is positive if and only if $a < \alpha_2(\gamma)$. It is possible to show that $\alpha_2'(\gamma) < 0$ and $\alpha_2(\gamma) = 2$ when $\gamma = 2$. Thus $\alpha_2(\gamma) > 2$, when $\gamma > 2$, but this is outside the range of "a" for which the original expression is valid. Thus, for $\gamma > 2$ and $a > 2$, the expression $W^N - W^S$ is negative. Finally, note that as γ approaches zero, $\alpha(\gamma)$ approaches infinity, so the range over which welfare is higher in the Nash case is larger. This is intuitively sensible. If the Stackelberg leader is more effective, but has a lower welfare weight, it is more likely that the Nash equilibrium will be better.

To summarize, we have two cases. If $\gamma < 2$,

$$W^N - W^S \quad \begin{array}{ll} < 0 \;, & 0 \le a < 1 \\ = 0 \;, & a = 1 \\ > 0 \;, & 1 < a < \alpha_2(\gamma) \\ = 0 \;, & a = \alpha_2(\gamma) \\ < 0 \;, & a > \alpha_2(\gamma) \end{array}$$

where $\alpha_2(\gamma) > 2$

If $\gamma > 2$,

$$W^N - W^S \quad \begin{array}{ll} < 0 \;, & 0 \le a < 1 \\ = 0 \;, & a = 1 \\ > 0 \;, & 1 < a < \alpha_1(\gamma) \\ = 0 \;, & a = \alpha_1(\gamma) \\ < 0 \;, & a > \alpha_1(\gamma) \end{array}$$

where $\alpha_1(\gamma) \le 2$

How does this result compare with the previous one for the special case when $\gamma = 1$? The striking thing is that, when the group that can precommit is relatively less effective, the value of γ does not matter: the precommitment equilibrium is always better. This is not too surprising in view of the underdog theorem, which established that both groups would be better off with the underdog precommitting, as compared to the simultaneous move case. When the leader is more effective in rent-seeking, γ does matter up to a point. The region over which the Nash equilibrium yields higher welfare shrinks as γ increases. This is also intuitive. If a higher welfare weight is assigned to the Stackelberg leader, it is less likely that the Nash equilibrium will be better in terms of resulting welfare. Thus the results of this section are a natural generalization of those in Kohli (1994). The Rawlsian welfare function in the next section leads to more marked changes in the results.

6. Equity and Rent-Seeking Costs

The Bergsonian welfare function considered in the previous section allows for distributional biases, but if the distributional weights are given, independent of relative effectiveness in rent-seeking, there is no equity concern built in. This is reflected in the fact that the results on welfare generalize the special case of equal weights (so the objective is minimizing rent-seeking costs), in that an intermediate value of relative effectiveness is worst, with welfare increasing the further one moves away from this value. This changes if, as in the example briefly described above, the distributional weight is inversely related to relative effectiveness ($\gamma = 1/a$, in the particular case treated). There, welfare is always decreasing in the relative effectiveness of the first group.

However, this is not a transparent way of introducing equity concerns in the welfare function. The more usual way is to allow for the isowelfare contours to be strictly concave rather than linear. Here we will consider the extreme case, of a Rawlsian welfare function, which gives sharp and nicely contrasting results. In particular, an intermediate level of relative effectiveness in rent-seeking now becomes *best* rather than worst! We will discuss the implications of this after we have presented the results.

Accordingly, the welfare function is given by

$$W = \min\left\{W_1^i, W_2^i\right\}$$

where i = N, S depending on whether it is a Nash or Stackelberg equilibrium. We examine each case in turn.

Using the analysis in section 3, we have

$$W_1^N = \frac{a^2 R}{(1+a)^2} \quad , \qquad W_2^N = \frac{R}{(1+a)^2} \quad .$$

Hence, it is clear that

$$W = \begin{cases} \dfrac{a^2 R}{(1+a)^2} \, , & a < 1 \\[2ex] \dfrac{R}{(1+a)^2} \, , & a \geq 1 \; . \end{cases}$$

Simple differentiation shows that the first part is increasing in "a," while the second part is clearly decreasing in "a." Hence we have the following result.

Proposition 1. In the rent-seeking game described above, if the groups move simultaneously and aggregate welfare is measured by a Rawlsian objective function, welfare is highest when the rent-seeking groups are equally effective.

Next, we turn to the case where group 1 can precommit its rent-seeking effort. Using the expressions from section 4, we have

$$W_1^S = \frac{aR}{4} \quad , \quad W_2^S = \frac{(2-a)^2 R}{4} \quad , \quad a \le 2$$

and $$W_1^S = \frac{(a-1)R}{a} \quad , \quad W_2^S = 0 \quad , \quad a > 2 \ .$$

Equating the first two expressions, we may solve for "a," this value being 1. Hence we have

$$W = \begin{cases} aR/4 & , \quad a < 1 \\ (2-a)^2 R/4 & , \quad 1 \le a \le 2 \\ 0 & , \quad a > 2 . \end{cases}$$

It is also easy to check that the first part is increasing in "a" and the second part is decreasing in "a." Hence, we have the following result.

Proposition 2. In the rent-seeking game described above, if one group is able to precommit its rent-seeking outlays and aggregate welfare is measured by a Rawlsian objective function, welfare is highest when the rent-seeking groups are equally effective.

Propositions 1 and 2 together suggest that if equity is an overriding concern, the institutions that govern rent-seeking should be designed to make the groups as equal in effectiveness as possible. This is irrespective of whether precommitment is possible or not. We shall turn next to the comparison of the Nash and Stackelberg cases with the Rawlsian welfare function. First, we note the stark conflict between equity and efficiency in the kinds of situations analyzed here. In the

Nash equilibrium, in particular, welfare is highest when the costs of rent-seeking are also highest, i.e., when the two groups are equally effective. The conflict is somewhat less severe in the Stackelberg case, since there rent-seeking costs are highest when the leader is somewhat more effective ($a = 3/2$). Either case is, however, suggestive of the Indian experience, mentioned earlier, where at some level there has been great concern for equity, implemented through policies such as restrictions on large firms and job reservations, while at the same time there has been a great deal of rent-seeking. Our analysis suggests that these two phenomena may well go hand in hand.

The comparison of Nash and Stackelberg equilibria in terms of the Rawlsian welfare function is summarized in the next proposition.

Proposition 3. With a Rawlsian welfare function, the Stackelberg equilibrium of the rent-seeking game considers here results in higher welfare than the Nash equilibrium if the leader is relatively less effective in rent-seeking. This ranking is reversed if the leader is more effective. If the groups are equally effective, welfare is equal in the two cases.

Proof

Let W^S and W^N denote aggregate welfare in the Stackelberg and Nash cases.

If $a < 1$,

$$\begin{aligned} W^N - W^S &= \frac{a^2}{(1+a)^2} - \frac{a}{4} \\ &= \frac{-a(1-a)^2}{4(1+a)^2} < 0 \end{aligned}$$

If $2 \geq a > 1$,

$$W^N - W^S = \frac{1}{(1+a)^2} - \frac{(2-a)^2}{4}$$

$$= \frac{(4+a-a^2)a(a-1)}{4(1+a)^2} > 0$$

If $a > 2$, obviously $W^N > W^S$.

If $a = 1$, $W^N = W^S = R/4$.

QED.

The result for $a < 1$ can also be viewed as a corollary of the underdog theorem in Kohli (1994), which showed that both groups are better off with the underdog precommitting. The result for $a = 1$ is a consequence of the coincidence of the Nash and Stackelberg equilibria in this case, also established in Kohli (1994). The main difference from previous results, therefore, is for situations where the leader is more effective in rent-seeking. With a Bergsonian welfare function, the Stackelberg equilibrium is preferred to the Nash case if the leader is considerably more effective (the precise value depending on the weight given to the first group). This does not happen if equity is the overriding concern: if the group that can precommit is more effective, the no-precommitment setup is always better in this case. This is quite intuitive.

The implications of this analysis are quite straightforward, within the context of the model. If equity is the overriding objective, rent-seeking institutions should give the underdog the advantage of precommitment whenever possible. Furthermore, the effectiveness of rent-seeking groups should be equalized as much as possible.[15] At the same time, this maximizes the conflict between

[15] Note that with exactly equal effectiveness, precommitment becomes irrelevant.

equity and efficiency, since with equal effectiveness of rent-seeking, the costs of rent-seeking can be highest.

7. Concluding Remarks

The analysis in this paper examines, in the context of a simple model, two kinds of policy responses in terms of designing the framework within which rent-seeking occurs. First, whatever the timing of rent-seeking efforts, or the possibilities for precommitment, the costs of rent-seeking are lower when the rent-seeking groups differ greatly in effectiveness. Thus, to the extent that this effectiveness is under the control of the government, or institution- or rule-makers in the government, it is beneficial to enhance the effectiveness of one side over the other if the goal is to reduce these costs. In the case of given social structures and group political influence, this kind of policy may be infeasible, but the analysis indicates where things ought to go if they could. Allowing for distributional considerations by considering a Bergsonian welfare function does not qualitatively modify this conclusion. Such considerations may point in the direction of balancing the effectiveness of rent-contesting groups to some extent, but even here great differences in effectiveness are better. However, when equity matters above all else, as in the Rawlsian case, this result is reversed: equal effectiveness is the best institutional setup for rent-seeking.

Now suppose that the relative effectiveness of rent-seeking groups is given, but the policy-maker can affect the order in which rent-seeking efforts occur. This is a second kind of policy to be considered. For example, in the case of allocating import quota licenses, applications could be considered simultaneously or sequentially. Kohli (1994) has the striking result that if one group is less effective, both groups are better off if that underdog can precommit. Therefore, if the rules can be set up to favor the "underdog," in the sense of allowing the less effective group to move first or otherwise precommit, this will be supported by everyone over the no precommitment case. However, if the alternative is for the more effective group to be the leader, clearly they will prefer that situation.

In comparing the Stackelberg and Nash cases when the group that can precommit is relatively more effective, we found that when the welfare objective is a Bergsonian one with given welfare weights, there is some intermediate range of effectiveness over which the Nash case is better, while when relative effectiveness is unequal enough, the Stackelberg case again gives higher welfare. This latter region is not present, however, when the welfare function is Rawlsian.

The underlying premise of our analysis is that, while rent-seeking may be inevitable at some levels, with self-interested bureaucrats or politicians responding to lobbying or other rent-seeking efforts, there may be other levels of government with objectives that are more oriented towards social welfare. This may be justified on sociological grounds (people differ) or in terms of the circumstances of time and place (constitution makers at the time of independence of a country may be relatively free of day-to-day influence activities that develop as the nation's institutions evolve). Such benevolence does not, however, require naiveté, and we have tried to explore some issues in how institutions may be designed to achieve welfare objectives when future rent-seeking is anticipated. Our main contribution in this paper is to explore the sensitivity of results in Kohli (1994) to variations in the government welfare objective.

Two limitations of our analysis may be addressed in conclusion. First is the special nature of the assumptions regarding the gains from rent-seeking, i.e., the probability of success or the share of the rent captured. We believe that a more complicated formulation would not alter the qualitative nature of our results. A second limitation is the exogeneity of the rent in our model. While this is an assumption shared by much of the rent-seeking literature, and is a natural one in some contexts, it is important to examine how our results are altered when the rent is endogenous. We have begun this task in Kohli and Singh (1993), and are continuing further research in this direction.

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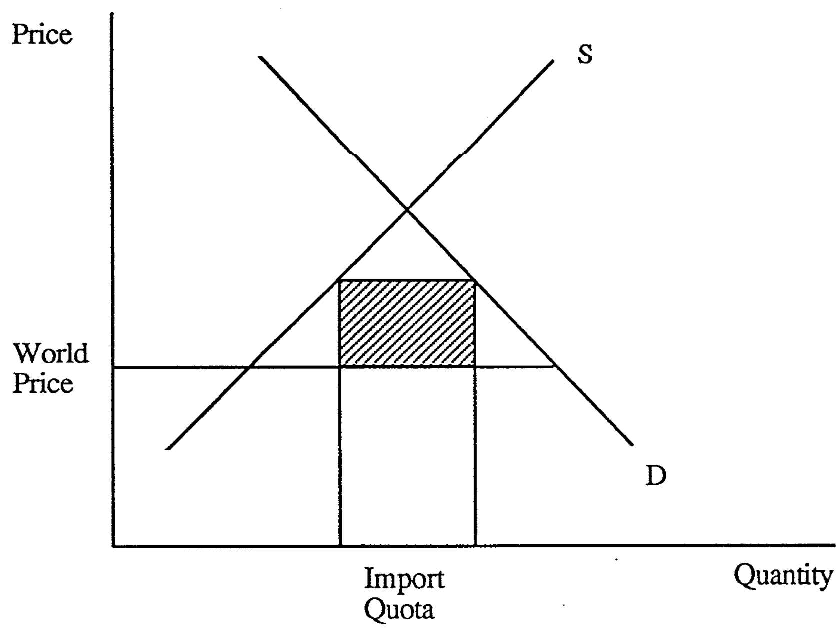

Figure 1

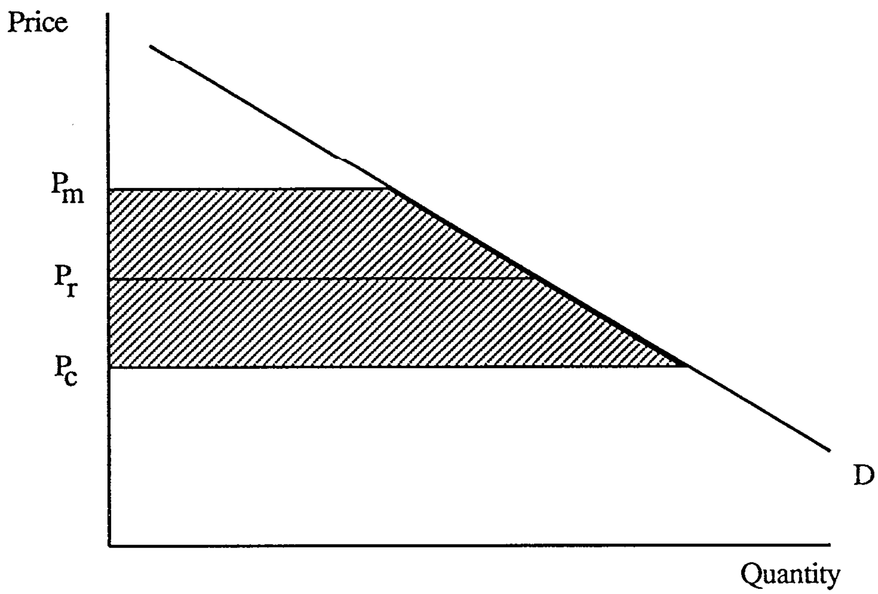

Figure 2